# Final Public Report for ESA-167-3

| | | | |
|---|---|---|---|
| **Company** | Bush Bros & Company | **ESA Dates** | September 9,10, 11, and 12 |
| **Plant** | Augusta Processing Plant | **ESA Type** | Steam |
| **Product** | Food | **ESA Specialist** | Roger Lawrence PE CEM |

## Brief Narrative Summary Report for the Energy Savings Assessment:

### Introduction – Basic Objectives and Approach

The objective of the ESA is to provide US Industry, in particular Bush Bros, Augusta Plant, with technical assistance targeted to reduce energy expenditures. The approach for the ESA is for the USA DOE Specialist to provide training in the US DOE tool and facilitate the completion of an abbreviated steam system assessment.

### Plant Overview

Bush Bros Plant processes canned food products. Raw materials are cleaned, mixed, canned and cooked. Steam plays a critical role in the heating of ingredients and the cooking process. Production runs for 6 days during 50 weeks a year, 24 hours a day. Two natural gas steam generators are currently in use alternately carrying the load and operating at a low firing rate. Feed water economizers are in place and working effectively to raise feed water temperature by 20-25°F. Steam is distributed at 110psig. The predominant use of steam is in the cooking retorts. There are also uses associated with heating ingredients and canning. Steam is directly injected into the cooking vessels containing the canned product. Condensate is not returned to the steam system but is collected in the main treated water reservoir. Cookers are pressurized and heated in sequence for periods determined by the size of the product. The boilers are regularly tuned to operate at low stack oxygen content. Continuous blow down analysis is used to control the blow down rate. Live steam venting from the steam traps on the distribution headers indicated that steam trap maintenance was needed. Monday startup requires additional steam to reheat process vessels that have cooled over the weekend. There was no steam metering.

### Summary of results

Potential for cost savings: **$105,000 per year**
Estimated capital equipment cost: **$69,000**

### Opportunities

Six energy saving opportunities were identified that would reduce energy expenditure and these were presented at the preliminary findings meeting.

### Project One – Change Boiler Efficiency by Installing Continuous Air to Fuel Ratio Controllers

A stack gas analysis revealed good combustion tuning in both boilers. The stack gas analyzer recorded a temperature of 360°F. Using the SSAT stack loss calculator boiler efficiency at 70% firing rate was calculated to be 83%. This food processing application requires a wide range of operational firing rates. Closed loop control of excess oxygen in the stack would provide optimized boiler combustion efficiency throughout the boiler firing range.

Using SSAT the estimated **savings for a 1% increase in boiler efficiency is $19K per year**. The cost of installing continuous air to fuel ratio controllers on two boilers is estimated to be $40K

*Project One: Medium-term opportunity*

**Project Two – Change Boiler Efficiency by Reconnecting the Stack Gas Economizer to the Make Up Water Line Supplying the De-Aeration (DA) Tank**

Presently the stack gas economizer is connected between the DA tank and the boiler. This reduces the potential heat transfer rate from the stack gas. The present differential temperature is 110°F. This could be increased to 200°F by feeding makeup water from the hot water tank at 150°F through the economizer as it enters the DA tank. The resulting increase in heat transfer rate to the boiler makeup water will reduce the stack gas temperature. The result of this change will be increased boiler efficiency.

The addition of a stack gas economizer typically increases boiler efficiency by an average of 3%. As the economizer is presently already in use, the additional savings achieved by doubling the differential temperature is estimated to be 50% of the full 3% or 1.5%.

Using SSAT a conservative estimate of the potential for **savings for a 0.75% increase in boiler efficiency is $14K per year**. The cost of reconfiguring the feed water pipes is estimated to be $4K.

*Project Two: Near-term opportunity*

**Project Three – Install a Steam Meter on the Steam Distribution Header**

Currently the quantity of steam used by the process is not measured. The installation of a steam meter on the steam distribution header would provide the production department with information that would enable them to avoid making excess demands on the boilers during times of maximum steam requirement. An estimate of steam production rate was calculated based on the annual quantity of make up water. The average steam production rate was found to be only 40% of the boiler capacity. This demonstrates ample boiler capacity. The solution to overload conditions is measurement and control.

The installation of a steam meter that produces an electrical output linked to the plant DCS system would provide operators information that would enable them to avoid overloading the steam system. For example cook room operators would be able to view the steam use, compare this with total steam capacity, and delay new steam loads appropriately. Based on this concept operators understood that if this information were to become available steam used in the pre-heating of ingredients could be reduced and the steam saved made available for the cooking process.

Using SSAT the projected **savings for 1% of steam use is $15K per year.** Conservatively it is estimated that the installation of a steam meter would save more than 1% per year. Additional savings will be realized through reduced maintenance on the boiler and process equipment. The cost of installing one steam meter with a communication link is estimated to be $10K.

*Project Three: Near-term opportunity*

**Project Four – Implement Steam Trap Maintenance Program**

Very few steam traps are used; an estimated total for the whole plant was arrived at by team consensus and thought to be 20. An inspection of the steam traps on the main header revealed one trap delivering live steam to an open process vessel and other traps venting to the ground.

To ensure that all malfunctioning steam traps (those closed, leaking, or blowing through) are identified and serviced, it is necessary to formalize a steam trap maintenance program. A suitable ultrasonic steam trap measuring instrument is already available at the plant. This instrument can be used to determine the operational effectiveness of each steam trap.

Using SSAT the savings potential associated with the repair of one failed steam trap on the high pressure header and the prevention of the escape of 0.027Klb/h is equivalent to $3K per year. For 6 traps this translates to a **savings opportunity of $18K per year**. No capital expenditure is required.

*Project Four: Near-term opportunity*

**Project Five – Implement Steam Leak Maintenance Program**

The implementation of a formal plant wide steam leak maintenance program would increase awareness of steam leaks and direct attention to the importance of identifying and correcting them.

Using SSAT, a formalized steam leak maintenance program will result in an estimated **savings of $8K per year**. There is no capital expenditure required.

*Project Five: Near-term opportunity*

**Project Six – Add Insulation to Process Vessels**

During the plant walk through it was evident that some steam headers and process vessels were either uninsulated or only partially insulated.

Using SSAT and a 2% steam reduction the projected **savings are $31K per year.** The cost of installing insulation is estimated to be $15K

*Project Six: Long-term opportunity*

**Two additional projects were presented to the plant:**

**Project Seven – Additional Tank Storage to Conserve Hot Treated Water**

At week's end all cooking vessels are emptied and some hot treated water is stored. Additional outside storage could be considered in conjunction with the optimization of the filling of cooking vessels and reuse of condensate. An engineering study would reveal ways to optimize the use and avoid unnecessary waste of expensive heat energy and chemically treated water.

**Project Eight – Use of Warm Well Water for Space Heating**

Product is cooled with chemically treated well water. This water is presently dispersed as warm irrigation water that could be passed through a water-to-air heat exchanger that would heat the warehouses. This would have the potential to displace natural gas presently used in space heaters.

Plant ESA Summary Report Table - information provided by the company

Fuels consumed at the Bush Bros Processing Plant Augusta, WI:

| | | |
|---|---|---|
| Natural Gas | | |
| | Energy Basis | 140,000 $10^6$ BTU/yr |
| The Impact Fuel is Natural Gas | | |
| Electric Power | | |
| | Power Basis | 694kW |
| | Energy Basis | 5,000,000MWhr/yr |

Fuel Savings: Near Term Projects 52%
Medium Term Projects 18%
Long Term Projects 30%

**Management Support and Comments:**
The training assessment was well supported by production, maintenance, and management. Attendance at the final discussion and presentation included some 15-20 plant personnel. There was a constructive interchange of ideas and acknowledgement that the sessions had been instructive.

**DOE Contact at Plant/Company:**
Follow up should be made with the Site Lead Todd Peterson